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Application of an Eco-Behavioral Approach to the Evaluation of Early Intervention Programs

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ABSTRACT

The Eco-Behavioral System for the Complex Assessment of Preschool Environments (ESCAPE) has been developed for the evaluation of preschool environments by way of the interactions of students with such aspects of the classroom ecology as activities, materials, and grouping configurations, as well as teacher behaviors. The system follows a momentary time-sampling approach and tracks individual children across all activities in a typical preschool day allowing for the recording of 12 categories of these variables. The ESCAPE system allows coding for (1) the variety of adults who interact with the child, (2) teacher behaviors directed specifically to a target child, and (3) simultaneous occurrences of three different categories of student behavior. Data can be summarized to represent the percentages of time the target child spends engaged in each coded variable or unconditional probabilities to indicate the probability of various student behaviors given a specific arrangement of ecological variables. Pilot data on 12 children illustrate the system's potential application with process-product program evaluation. Implications of expanding the focus of process assessment beyond student behavior to include ecological and teacher behavior variables within early intervention program evaluation research are discussed. (Author/DB)

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Abstract

For more than 20 years, a debate has simmered in both public and academic arenas over the question: "Is early intervention effective?". No single response can be made to the question of whether or not early intervention programs are effective because the majority of studies have failed to assess the independent variable--early intervention. As a result, the unassessed variation in progam implementation has been a persistent confounding variable in most experimentally controlled studies of preschool intervention. This chapter describes a direct observational approach for quantifying several independent variables within preschool classrooms, their interactions, and their effects on behavior. This system, the Eco-behavioral System for the Complex Assessment of Preschool Environments (ESCAPE-Carta, Greenwood, & Atwater, 1985) is described along with pilot data on 12 children to illustrate its potential application within process-product program evaluation. The implications of expanding the focus of process assessment beyond student behavior to include ecological and teacher behavior variables within early intervention program evaluation research is discussed.

Introduction

For more than twenty years, the field of early intervention programs has been involved in a self-evaluation process. Generally, this evaluation of programs for young children with special needs has been carried out to justify the existence of early intervention. The process began with the need to evaluate a national experiment called "Headstart". The hypothesis underlying this experiment was that early intervention in the lives of young children from deprived environments could help "break the cycle of poverty" and improve their future opportunities. The goal of evaluating these programs was to answer the central question "Do these programs work?". Emphasis was placed on how children changed as a result of special preschool experiences. The most common design for this evaluation was the pre-post treatment group only design (Campbell & Stanley, 1963) with IQ generally being employed as the unitary index of outcome (Hubbell, 1983).

This same evaluation design, based exclusively on outcome measurement, has been widely applied to preschool programs for handicapped children (White, Mastropieri, & Casto, 1984). Here the focus of program evaluation has been to determine whether programs can bring about change in the lives of young children. Usually, the impact of a program is based on pre-post analyses of outcomes contributed by participating children and parents. For example, Bricker and Sheehan (1981) evaluated a special preschool

program by administering norm-referenced and criterion-referenced tests to their students in the fall and in the spring over two consecutive years. All handicapped and nonhandicapped subgroups of students in the program made significant gains on all tests. Bricker and Sheehan concluded that the program had produced improvements in important domains of participants' behavior. However, they cautioned that the determination of causal relationships between the program and children's gains is difficult, primarily because of the constraints against control group designs when applied to programs for handicapped students.

Some variations have been made to strengthen program evaluations based on pre-post treatment group only designs by obtaining assessments of participants after they have left the programs (Karnes, Schwedel, Lewis, Ratts, & Esry, 1981). For example, Moore, Fredericks and Baldwin (1981) found that when 9-, 10-, and 11-year old students in classes for the trainable mentally retarded were tested with standardized tests, significant differences existed in the language, academics, self-help, and motor skill performance of those who had attended preschool for two years versus those who had never attended preschool. This type of follow-up information has provided some indication of long-term effectiveness of special preschool programs.

Unfortunately, these attempts at evaluating early intervention programs suffer from two major flaws: they

seldom include control groups in their designs, and they rarely provide information about the program or the independent variables experienced by the participants. The first flaw has been widely discussed in the literature and reflects the ethical constraints involved in withholding intervention from children with special needs if the resources are available (Bricker & Sheehan, 1981; Sheehan & Keough, 1982).

The second flaw in these studies concerns the failure in most evaluation efforts to assess the degree and quality of program implementation. Past evaluative studies have tacitly assumed that: (a) programs are implemented exactly as written in program manuals without variation, and (b) participants experience these programs in exactly the same way. Both of these assumptions are faulty.

An intervention approach is not always implemented as it is intended and evaluation must consider the variation in implementation that occurs across implementers and over time. Method calibration, as discussed by Peterson, Homer, and Wonderlich (1982) and procedural reliability (Billingsley, White, & Munson, 1980) are methods discussed in the literature for monitoring the quality of implementation. Greenwood, Dinwiddie et al. (1984) noted that one teacher's departure from a standardized tutoring procedure affected students' academic performance. Obviously, variation in program implementation potentially confounds evaluation studies and must be controlled.

Therefore, we must go beyond the measurement of student variables in our program evaluations by examining the array of factors within programs that may affect student outcomes.

Another unfounded assumption in current program evaluation methods is that participants in a single program have the same experiences. In fact, a considerable amount of variation exists in students' moment-to-moment and daily interactions with the stimulus events in an intervention environment (Patterson, 1982). We agree with Bijou and Baer (1978) that:

> The interaction between the child and the environment is continuous, reciprocal, and interdependent. We cannot analyze a child without reference to an environment, nor is it possible to analyze an environment without reference to a child. The two form an inseparable unit consisting of an interrelated set of variables, or an interactional field. (p. 29)

These interactions should be the units of analysis in evaluating the process dimensions of early intervention programs.

A technology for assessing child-environment interactions exists in applied behavior analysis (Wolery & Bailey, 1984). This technology typically uses an experimental analysis of component to assess the manipulation of one variable at a time and the effect of this manipulation on student behavior. Numerous studies of this type have focused on single aspects of preschool programs and their effects on student behaviors. Some of these

include investigations of specific aspects of the classroom environment (e.g., Doke & Risley, 1972), teacher behaviors (e.g., Hart & Rogers-Warren, 1978), and peer behavior (e.g., Apolloni, Cooke, & Cooke, 1977). For example, Goetz, Ayala, Hatfield, Marshall, and Etzel (1983) accelerated students' clean-up behavior through the use of an auditory stimulus that been paired with teacher praise.

This applied behavior analysis approach offers precision by specifying the functional effects of the environment on children's behavior. Seldom however has this technology been applied in complex program evaluations. Typically, behavior analyses assess one dimension of the environment as the independent variable. While this is a powerful methodology, it may be an inefficient means of examining the effects of programs. Advances in program evaluation methodology require analyses of students' behavior in response to multiple aspects of their environments over time.

In summary, current approaches to evaluating programs for young children with special needs range from those that are broad enough to capture several elements at once but are imprecise and insensitive, to those that are precise but fail to capture the multidimensionality of the classroom ecology. We presently lack the proper tools to examine children's moment-to-moment interactions with their environment and determine how these interactions affect development over time. Currently, we are

like people who need bifocals to read the newspaper. If someone gave us a pair of binoculars, we could see the paper from a great distance and know it was there, but we could not decipher the letters because our instrument would lack the sensitivity that we required. Likewise, if someone gave us a microscope, we could see very specific details in the newsprint, but we would lose the context of word sequences on the printed page that tell the story. We have opted for precision at the expense of perspective.

A recently developed approach to assessment and evaluation fills several gaps in our efforts to determine the efficacy of early intervention programs. The eco-behavioral approach to program evaluation:

> is a means of assessing program variables through systematic observation and measuring the moment-to-moment effects of an array of variables upon student behavior. The temporal interactions between immediate program variables as ecological stimuli and student behaviors are the units of analysis for predicting or otherwise investigating program outcomes (e.g. developmental gain or long-term achievement) (Carta & Greenwood, 1985, p. 92)

Our group at Juniper Gardens Children's Project (Greenwood, Schulte, Kohler, Dinwiddie, & Carta, 1986) has been applying this approach to analyses of instruction and achievement in elementary classroom settings. In this line of research, an

observational coding system, the Code for Instructional Structure and Student Academic Response (CISSAR--Stanley & Greenwood, 1981) has been used to assess children's classroom performance as it is affected by several concurrent variables: subject matter, instructional materials, physical grouping, teacher location, and teacher behavior. In addition to concurrent relationships, the code has been used to measure the sequential relationships between environmental stimuli and behavior. This analysis is applied to ecological and behavioral categories of variables which are alternately sampled closely in time. For example, the teacher's behavior is coded in a ten second interval just preceding the coding of the student's behavior. In this fashion, the sequence "teacher instruct", followed by "student read aloud" may be recorded. By alternately sampling the teacher, then the student, the contextual basis for student behavior is included within the observational record for later analysis.

At Juniper Gardens, we have used the student behavior scores from the CISSAR to experimentally determine the best predictors of student achievement (Greenwood et al., 1984). The approach is a process-product design in which process measures (observed CISSAR scores of ecology and student behaviors) are quantitatively described and then examined in terms of academic gains (product measures). This approach has been used extensively in the teacher effectiveness literature in correlational and experimental studies to link specific aspects

of teacher behavior to academic achievement (Brophy & Good, 1986; Brophy & Evertson, 1977; Soar, 1973).

How then is this eco-behavioral approach to evaluation an improvement over more traditional means of evaluating early intervention programs? First, it will allow us to quantify several process dimensions of a program across several points in time. As a result, we will be able to determine what variables of a program or a specific treatment are in place, how ecological, teacher behavior and student behavior variables interact, and whether or not these interactions maintain over time. Second, we will be able to study the way specific student's behaviors are affected by ecological and teacher behavior of variables within the program at several points in time. Examining the interactions between treatment variables and student behavior variables will allow us to explore the environmental factors that produce general effects across all students and more specific effects as exhibited by individual students. Third, by combining the eco-behavioral interaction methodology with the process-product design, we can take a major step toward determining the precise elements of programs that are responsible for producing programmatic effects. In short, this new technology promises to add both precision and perspective to our program evaluation efforts.

Development of an Eco-Behavioral System for Program Evaluation

Because an eco-behavioral system for evaluating early intervention programs had no direct parallel, our development task was at once challenging and awesome. Our purpose was to design a means of determining not only which programs were successful, but what aspects of programs produced successful outcomes. Our goal was to craft an observational tool to define and contrast programs that vary along a host of ecological and teacher behavior dimensions. A computer search of the ERIC database conducted in November of 1984 had revealed 171 citations concerning preschool observation techniques. These citations revealed instruments varying from observation checklists and scales to those that observed actual frequencies or sampled rates of events or behaviors. None of the existing observation systems looked at the interactions between individual students and environmental variables and teacher behaviors. It was apparent that improvement in children's achievement through early intervention was the result of their daily interactions with the intervention environment. Therefore, we wanted to fashion an observational evaluation system that would (a) define the topographical features of the environment, (b) examine the interactions that occur between the environment and student behaviors, and (c) capture the student behaviors most likely related to developmental gains. Given that direction, a number of questions were addressed in developing ESCAPE.

What Should Be Included as Codes?

Four major steps were followed in the initial process of selecting and validating the codes that would be used to define early intervention programs. First, two literature reviews were conducted. The first of these concerned previous approaches for determining effectiveness of special preschool programs (Carta & Greenwood, 1985). This activity confirmed the absence of eco-behavioral approaches for evaluating early intervention programs and provided a perspective on the outcome measures currently used for program evaluation. The second literature review identified ecological factors that had previously been linked to instructional effectiveness in preschool classrooms (Carta, Sainato, & Greenwood, in press).

A second major activity in developing the code was to conduct informal observations in a variety of preschool programs in order to identify the range of features of these classroom environments that would characterize each one and that potentially would differentiate each program from the next. An initial list of codes was developed and some tentative definitions for each code were proposed. The observation system was then pilot tested on a variety of classroom environments and some initial data collected on interobserver reliability. A third major activity occurred as the instrument was submitted to an expert review process to obtain feedback about its content validity from researchers in the field and from preschool

teachers. The fourth major activity was a final revision that was conducted following a pilot study and the experts' review. Based on this process, the observational system was developed with three major code categories: ecological elements, teacher behavior and student behavior. The following sections will describe those three categories.

Ecological categories, subcategories, and codes. The ecological category of ESCAPE contains those variables that describe the classroom environment. These are background features considered most likely to affect student behavior as setting events or as discriminative stimuli during classroom instruction. Decisions to include any single code were based on our observations of preschool situations and on previous research noted in the literature (Bailey, Clifford & Harms, 1982; Carta, 1983; Rogers-Warren, 1982; Sainato & Lyons, 1983; Shure, 1963). The ecological category, subcategories, and codes are listed in Table 1.

Insert Table 1 About Here

Designated Activities were defined as the learning experiences being provided to the observed student or the subjects of instruction. "Pre-Academics" and "Story" are two examples of the fourteen codes included in this subcategory. The

Activity Structure was defined as the degree to which a teacher directed the activity coded above. This amount of direction was determined by two factors: whether the activity was initiated by the teacher or the child, and the frequency of task-related comments made to the observed student by the teacher. Examples of codes within this subcategory were: "teacher choice/high structure", "teacher choice/low structure", and "child choice/low structure". Materials were defined as those objects with which the target child was engaged or to which the child was attending. "Instructional materials" and "pretend play toys" were examples of two of the twelve material codes. Location was defined as the physical placement of the target child. "On floor" and "at tables" were two of the seven locations that were scorable. Grouping was defined as the number of students who were engaged with similar materials and in the same vicinity as the target child. "Solitary" and "small group" were two codes in this subcategory (see Table 1). Lastly, Composition was defined as the ratio of handicapped and non-handicaped students within the group coded in the Grouping field described above. Examples of the available codes were: all handicapped, majority non-handicapped, and majority handicapped. This particular subcategory of variables was included to record the configuration of children in integrated and segregated classroom environments. This has been a popular topic in the recent literature as researchers have attempted to document the effects of

mainstreaming on both handicapped and non-handicapped students (e.g., Cooke, Ruskus, Apolloni, & Peck, 1981; Fenrick, Pearson, & Pepelnjak, 1984).

Teacher category, subcategories, and codes. Three subcategories of teacher variables were defined. While these teacher variables could easily have been considered ecological variables, in that they set the occasion for the student to respond, we wanted the capability of analyzing this category of codes as either independent or dependent variables affected by the complement of ecological variables that were in place. For example, a teacher's behavior might shift according to the activity or the materials being presented. Thus, we separated the teacher categories from the ecological categories.

The teacher subcategories are also listed in Table 1. Teacher Definition referred to the primary adult observed interacting with the target child, or if no interaction occurred, then the adult who was nearest to the target child. This subcategory was viewed essential to the accurate description of the numerous adults who instruct and interact with students in special preschools. Examples of the eight variables coded within this subcategory included: teacher, aide, and ancillary staff member (e.g. speech therapist or occupational therapist). Teacher Behaviors were defined as the behavior being emitted by the adult defined as the teacher in the prior code listed above. Some examples of the eight teacher behavior codes included:

"verbal prompt", "gesture", and "disapproval". The last subcategory in the teacher category, Teacher Focus, indicated the diraction of the teacher's behavior and was included because coded teacher behavior was not always directed toward the observed child. Sometimes, the adult designated as the teacher of the observed child emitted behaviors that were intended for another child, or all the children in the class. In order to discriminate between the teacher behaviors aimed specifically at the target child and all other teacher behaviors, the following Teacher Focus codes were included: "target child only", "target child and others", "no one" and "other than the target child".

Student behavior codes. Two considerations guided our categorization of student behavior. First, we wanted behavior codes to be specific responses that potentially were responsive to momentary changes in ecological and/or teacher behavior variables. Second, in a departure from prior conventions in coding systems, we wanted to be able to code three types of student behaviors concurrently: those that were Appropriate or generally task-related, those that were Inappropriate or considered unacceptable by adults in the classroom, and verbalizations (Talk) by the observed child. While these could have been structured into one extensive list of behaviors, we were interested in the interrelationships among these three classifications of behaviors. For example, we were interested in determining if some children verbalized more frequently when they

were engaged in certain types of behaviors. Similarly, we sought to ascertain whether changes brought about in certain behaviors produced corresponding changes in co-occurring inappropriate behaviors. These types of questions would only be answerable when different classifications of behaviors could be scored concurrently. Some examples of the ten Appropriate Behaviors included: "academic work", "manipulating", and "pretending". Three of the five codes for Inappropriate Behaviors included "off-task", "acting-out", and "self-stimulation". Talk was coded as: "verbalization to teacher", "verbalization to peer", and "undirected verbalization".

What Should Be the Basic Unit of Observation?

In using an eco-behavioral approach to evaluate an early intervention program, several options were available as the basic units of observation. For example, the teacher, all members of the class, or individual children within the class could have become the subjects of observation. We chose to focus on individual children as the conceptual unit of observation and analysis. This decision was made because (a) we were ultimately concerned with evaluating programs in light of individual children's developmental outcomes, and (b) we wished to link individual children's daily eco-behavioral interactions with gains achieved in a designated period of time. In actual practice, when ESCAPE is used to evaluate a program, ecological, teacher, and student behavior variables are recorded by one

observer in relationship to a single target student who is the unit of analysis. We opted for data intensive sampling of the ecology and behavior of specific children instead of pursuing a general picture of several students across a class. Our concern was that sampling across different target subjects in the same session lowered the amount of data available for each single subject resulting in an inadequate description of the ecological factors that influence a single subject's behavior.

How Should Variables Be Measured?

The large number of codes and the resulting complexity of the observational system necessitated the use of a momentary time sampling method for estimating rates of events and behaviors instead of a method that counted actual frequencies. Because codes were included to capture both slowly changing and relatively transitory variables (i.e., ecological and behavioral elements), a momentary interval sampling system was selected so that probabilities of events and responses of short and long duration could be estimated. This system also made it possible to combine single codes in various combinations to yield composite scores.

The ESCAPE system uses a 15-second momentary time sampling of multiple events. The system codes twelve subcategories in all. Observers code three subcategories at the beginning of each 15 second interval. One pass through all twelve subcategories in the code requires four 15 second phases in 60

seconds: Phase 1--designated activity, activity structure, and materials; Phase 2--location, grouping, and composition; Phase 3--teacher definition, teacher behavior, and teacher focus; and Phase 4--student appropriate behavior, inappropriate behavior, and talk. This sampling pattern gives equal weight to each of the twelve variables in the observational system. In Table 2, an actual segment of an ESCAPE record depicts the temporal relationship of the 12 subcategories within one complete interval.

Insert Table 2 about here.

Results From a Pilot Study Using ESCAPE

ESCAPE affords a number of different types of measures that can be used for evaluating early intervention programs. The discussion that follows illustrates the variety of data generated and types of questions addressed by ESCAPE.

Subjects

This study was conducted in four preschools located within metropolitan Kansas City. Parental permission was obtained for 70% of the students in the four classrooms. Three students for each classroom were randomly selected from the pool of students who returned signed permission slips. Of the twelve students randomly selected for the study, ten were classified as having special needs while the remaining two were nonhandicapped

preschool students. The disabilities of the children with special needs were Down's Syndrome (3) moderate mental retardation (5), speech and language impairment (2), physical impairment (1) and multiple handicaps (1). Chronological ages of the students ranged from 3 years 9 months to 4 years 11 months. Their developmental ages ranged from 2 years 1 month to 5 years 3 months.

Settings

Observations were conducted in four preschools selected because they differed in both program philosophy and in the type of children they served. Of the four preschools, three were university affiliated and acted as training sites for students in a variety of disciplines. One of the university sites served only students with handicaps, another was primarily aimed at preschoolers with special needs but integrated these children with a nonhandicapped group during lunch. A third university setting was a demonstration preschool that had mainstreamed one physically handicapped student. The fourth preschool was a privately funded setting that contained all special needs students but incorporated one nonhandicapped peer as a model. Two of the programs were half day programs and two were full day programs. In each setting, observations were conducted for the entire length of the school day with only nap and bathroom times being eliminated as opportunities for data collection.

Observer Training

Following an application and interview process, six observers from the local community and from the university were hired and began training. Instruction took place for a 3-week period, for approximately 10 hours per week. Observers first learned the names of the codes, the alphabetic equivalents, and the code definitions. They then practiced coding by reading written examples of preschool situations and applying the pertinent code. Observers began using the code in actual preschool settings by recording the full set of codes with a 30-second interval. When they became proficient in coding using this lengthened interval, they observed and recorded a set of variables every 15 seconds, the interval employed throughout the study. Cassette tape recorders signalled 15 second intervals to pace coding.

Reliability

Interobserver agreement was tested during training by pairing observers for repeated 25-minute observer checks. Observer pairs were rotated in such a way that each observer checked agreement with a different observer every day. Agreement was also checked across the four preschool settings that would be used in the actual study. Reliability was computed by using a percentage agreement method, [(# of agreements/ # agreements + # disagreements) X 100]. In this way, line-by-line agreement was computed separately for occurrence of each subcategory. During

training, average reliability across all subcategories ranged from 72% to 95%. Observers were considered proficient when they had conducted three consecutive reliability checks with at least 70% agreement as measured over all subcategories with no one subcategory falling below 70%. In complex coding systems, percent agreement levels of 70% or higher have been suggested as adequate (Jones, Reid, & Patterson, 1975).

During the study, interobserver agreement measures were collected on one-third of the observations distributed across subjects and settings. Average reliability during data collection ranged from 84% to 94% across all subcategories. The lowest percentage agreement for any one pair of observers on any single reliability check across all subcategories was 68% and the highest percentage agreement was 98%.

Data Collection and Analysis

Three randomly selected students were observed in each of the four preschool classes (N = 12) distributed over a total of 40 days. The total number of days observed on individual students ranged from 5 to 10 days. The total number of observed intervals (minutes) for each student ranged from 538 to 1989. Each student was observed on at least one Monday, one Tuesday, one Wednesday, one Thursday, and one Friday to account for program differences resulting from daily schedule changes. Observations on individual children were separated by approximately 5 days over the course of the project.

As mentioned previously, individual children were observed during their entire school day. On each day of data collection, one observer monitored the designated target child from the moment the child entered the classroom in the morning until the child left for the day. The only times eliminated from observation were naptimes, bathroom breaks, and a five minute observer break each half hour.

Daily data for each child were maintained so that variations across days could be examined for each child. Summaries over all observed days for each child were computed so that variations across children within a program could be examined. Scores for all children within a classroom could be computed in order to define and contrast programs at the broadest level. Finally, scores across all programs could be summarized to form a global and structural description of the ecologies, teacher behvaior, and student behaviors of all children across all settings.

At each of these levels (i.e., across days, children, and settings), molar and molecular descriptions of classrooms and behaviors were possible. Molar descriptions of preschool programs were derived by computing the percentage occurrence of each variable on the code. These unconditional probabilities for events provided estimates of the relative probabilities of occurrence for each coded classroom event. These scores permitted statements about the classroom ecology, such as the proportion of the preschool day the children spent in specific

activities, with specific materials, or in particular grouping arrangements. Similar descriptions could be made about the proportion of the day that the teacher engaged in various behaviors and likewise the proportion of the day the student emitted specific types of behaviors.

Molecular descriptions of eco-behavioral interaction were derived by computing the conditional probabilities of various combinations of variables on the code. These scores allow us to ask questions about classrooms regarding jointly occurring events. For example, given a specific type of activity, in what types of behavior was the student most likely engaged? Given a specific type of instructional grouping, in what types of behavior is the teacher most likely to be engaged? Given a specific teacher behavior, in what types of appropriate behavior is the student most likely to be engaged? Are students more or less likely to engage in talk given that they are engaging in a certain type of appropriate behavior?

For this pilot study, data were collected on 92 different variables across 12 children within 4 preschool settings across several days. When the various combinations of variables and the different levels of analysis just discussed were considered, the array of results available for interpretation was enormous. For purposes of this chapter, we have chosen to filter this quantity of information by focusing on results that illustrate the types of analyses available through the eco-behavioral approach to

assessment. The results chosen will be discussed in terms of the richness of description they can provide for program evaluation and the particular advantage imparted in evaluation research.

Results

General molar descriptions. When observations of all children were considered as a whole, the 87 days of ESCAPE data yielded a description of a typical classroom day. First, the most frequently occurring classroom activity was transition. The data in Figure 1 show that more than 20% of the typical day was spent in transition. This activity was coded when children were either between activities or in no activity. Play was the second most frequent activity, occurring for 20% of the day. Only 10% of a typical day was devoted to pre-academic activities (See Figure 1).

Insert Figure 1 about here.

Second, the data in Figure 2 show that children were most frequently observed to be engaged with no materials at all (30% of the typical day). The most common type of materials coded were food or food preparation materials (18% of a day). Instructional materials were coded in fewer than 11% of the total number of intervals (See Figure 2).

Insert Figure 2 about here.

Third, the data in Figure 3 indicate that the most frequently coded behavior was attending (i.e., looking at a teacher who was discussing or instructing, or at a peer involved in an interaction with the target, or at some instructional or play material), occurring in 46% of all intervals. During only 36% of the day were children engaged in some type of active behavior (i.e. manipulate, self-care, gross motor, pretend, academic work, or sing/recite). Two percent of the typical classroom day was spent in academic work.

Insert Figure 3 about here.

Collectively, the results presented so far suggested a general pattern of non-preacademic instructional emphasis and of student nonengagement. For example, children were most often engaged in transition, followed next in rank order by play. Only 10% of the day was devoted to preacademics and students were most often not engaged in the use of specific materials. Students spent the largest portion of time passively attending or looking at the teacher or materials. Students were not highly engaged in active behaviors (e.g., academic work). The analyses that follow

refine these points by examining effects within and across preschools.

Molar comparisons of preschools. Molar comparisons provided some interesting structural differences across the four preschool classrooms. For example, we have already mentioned that across all preschools, 21% of a typical day was spent in transition, meaning that no activity was occurring.

Insert Table 3 about here.

Table 3 presents the means for each preschool. Preschool 3 spent 30.3% of a typical day in transition, while Preschool 1 and Preschool 2 spent only half this amount of time in this activity. Another striking contrast existed within the pre-academic activity code. An average of 9.9% of total time was spent in pre-academics across preschools. However, this varied from a mean percentage of 1.8% in a typical day at Preschool 3 to 19.6% at Preschool 2. In future research with the ESCAPE, the differences in process measures across the various codes when correlated with gain scores that children receive on standardized tests, as in a process-product design, may shed some light on the preschool setting variables that are most critical in influencing children's achievement.

Another ecological subcategory that provided a striking contrast across classrooms was location. Overall, children spent

most of their time sitting at tables (M = 43.7%). This ranged from 20.9% at Preschool 2, to 66.3% at Preschool 4. As seen in Table 3, children in all three preschools serving primarily handicapped students spent at least twice as much of their time sitting at a table than in any other location. In the mainstream preschool, children occupied a greater variety of locations and were frequently found on the floor (39.4%). This difference suggests the possibility of important instructional differences related to handicapped versus nonhandicapped children. For example, are handicapped children restricted to specific locations as a way of reducing their inappropriate behaviors or do these children more often limit themselves to certain areas of the classroom? In any event, these ecological restrictions may also impose some limitations on the appropriate behaviors emitted by handicapped students.

The teacher category provided another interesting set of contrasts across preschools. The profile of teacher definition codes (see Table 3) indicated that the adult most commonly coded as interacting most with the observed child was an aide (M = 46.5%). This was especially true in Preschools 3 and 4 where 72.9% and 64.9% of intervals were coded in this manner. Aides interacted with children much less frequently in Preschools 1 and 2; rather, the teacher or student teacher was most likely interacting with students. Delineation of the most frequent adult to interact with a student may be a telling distinction in

light of the quality and quantitive of teacher behaviors students receive from adults in the two settings. The two classrooms in which aides were most frequently coded revealed relatively high frequencies of physically assisting and disapproving by teachers. The data from the other two preschools revealed that discussion was a much more frequent teacher behavior. In either case, these data concerning the specific adults who interact with students and the behaviors they use for instruction, will be differentially related to student outcomes in subsequent process-product evaluation studies (cf. Greenwood, Delquadri, & Hall; 1984).

These same two sets of preschools provided other interesting differences for some child behavior variables. Table 2 illustrates, for example, that students in Preschools 3 and 4 engaged in considerably more inappropriate behavior, especially self-stimulation. Students in Preschools 1 and 2, on the other hand, engaged in much more talk, with students in Preschool 1 directing most of this talk to teachers. Students in the mainstream setting (Preschool 2) were more likely to engage in talk with peers.

Preschool comparisons such as these help refine our research hypotheses concerning the problem of low student engagement and the configuration of the classroom environment in terms of ecological and teacher behavior factors. Within schools mainstreaming handicapped children, differences in location,

adults interacting with students, adult behavior, and student behavior are clearly apparent, compared to regular preschool classrooms in which all students are handicapped. It is legitimate to ask to what extent these difference relate to differential student engagement. For example, do less trained aides set the occasion for more or less student engagement? Are low skilled and handicapped students responded to with more physical assistance and help than nonhandicapped students? How does this affect student behavior?

Molar descriptions of children within preschools. While the information presented above can tell us much about several dimensions of the classroom ecology and teacher and student behavior, analyses conducted at the classroom level mask individual student variability in response to the program.

Insert Table 4 about here.

Molar descriptions of the three target children in Preschool 2 are presented in Table 4 with regard to activity, teacher behavior, and student behavior. Each child was observed on five different days without two children ever observed on the same day. Interestingly, the proportions in Table 4 make it clear that there was an overall consistency to the student's code profiles activities, teacher behaviors, and appropriate student behaviors. This consistency was reflected in the relatively high

correlations between student profiles. These ranged from 0.75 to 0.93 for activities, 0.98 to 1.00 for teacher behaviors, and was 0.98 for appropriate student behaviors across the three students. Apparently the continuity in the program from day to day served as a structural template for student behavior. Yet, while the rank orderings of variables in these profiles were similar, there were some rather large differences across these students.

The percentage of time that the three children spent in activities is variable in this regard because the children in this preschool could choose among several available activities during a significant portion of the day. Larry, for example, spent the greatest proportion of his day in pre-academics, 14.3%, while Hope and Rick spent most of their time in play 27.2% and 35%, respectively. Activities that were scheduled every day and required all children to participate (e.g., snack, class business, music, and self-care) varied much less across the three children. Teacher behaviors demonstrated considerable stability across children. The only exception to this is the higher percentage of time in physical assistance given to Rick, the only child who exhibited a physical handicap (7.6% compared to 2.4% and 1.4%).

These results demonstrated that the environments and behaviors of students can show both consistency in their structure but can also yield student differences in magnitude of

specific events. The next analysis looked within subjects to examine the stability of events over time.

Descriptions of individual children's daily variations. The three panels in Figure 4 illustrate the relative magnitude of one student's percentage scores for three subcategories over days.

Insert Figure 4 about here.

These data not only depict daily variation; they were selected to illustrate additionally the relative range in magnitudes within subcategory codes. The uppermost panel illustrates the daily variation in the proportion of time spent in two designated activities: transition and pre-academics. For this student, transition ranged from 18.4% on Day 1 of observation to 45.0% on Day 4. Similar variation is evident in the proportion of time spent in pre-academics for this child, ranging from 1.3% on Day 1 to 29.6% on Day 2. Daily changes in ecological variables such as these demonstrate the rather dramatic differences in programs that individual children experience across days in a single classroom setting.

Less variation was noted in some of the teacher behaviors directed toward the observed child. The middle panel of Figure 4 illustrated this trend in two teacher behaviors (i.e., verbal prompting and approval). These figures for verbal prompting

ranged from 6.6% on Day 6 to 23.1% on Day 8. Teacher approval was even less variable, ranging from 0.6% to 3.5%.

The bottom panel in Figure 4 represents two student behavior variables that were most widely discrepant in occurrence. Attending occurred for at least a third of the total class time on 9 out of 10 days. Talk to teacher, on the other hand, never occurred more than 10% of the total class time on any given day.

Summary of molar analyses. Molar analyses are helpful in making global statements about the structure of time spent within different ecological factors (e.g., different activities, materials, grouping configurations), and within various teacher and student behaviors. This information can be useful in making comparisons across settings, students, and days for individual children. These particular data also confirm an important point, that preschool intervention is not a unitary variable that is either "on" or "off" within an experimental manipulation. Rather, it is multitude of factors of different magnitudes. These molar data are also typical of much of the direct observation research conducted in preschool settings (e.g. McWilliam, Trivette, & Dunst, 1985; Stoneman, Cantrell, & Hoover-Dempsey, 1983).

Molar process description of preschool programs is comparable to a picture that is painted with giant brush strokes. While the parts of the program have been outlined, the finer points and their interactions remain for further analysis, that is, for molecular description. For example, our data has

suggested differences in process structure (e.g., high levels of transition, low rates of student engagement and high rates of attending). At this point, however, we have established neither the temporal correlation of transition and engagement nor any causal implications of the effects of transition on engagement. This perspective can only be obtained from observational systems and process measures that are designed to capture temporal and sequential relationships. The following section will illustrate the advantages of such an eco-behavioral analysis.

Molecular descriptions of preschools. The advantage of molecular analyses of classroom interaction on the contemporaneous occurrence of process variables is that they allow for the examination of function. Thus, they permit us to determine the temporal correlations ecological and behavioral variables. Table 5 presents one such analysis based upon consolidation of 10 days of observation for one child.

Insert Table 5 about here.

This analysis was prompted by a teacher concerned that children (and one particular child) in her class were spending too much time during the day sitting and waiting. This molecular description of student appropriate behaviors by class activities was completed to determine the situations in which this child was

actively engaged versus those when he was merely attending or doing nothing. To simplify the analysis, an engagement composite score was formed consisting of several single appropriate student behavior codes (i.e., manipulate, self-care, gross motor, pretend, academic work, sing/recite).

The analysis confirmed the teacher's concern about the lack of engagement. The base level for engagement for this student (the probability that an engaged response would occur at any point throughout the day) was .323. This student was much more likely to be attending (p = .470). The conditional probabilities within the table indicated that an engaged response was much more likely to occur during certain activities. For example, an engaged response was much more likely during self-care, play, and fine motor activities, .652, .579, and .543, respectively. Engagement was much less likely during story, transition, and gross motor activities at .118, .136, and .145, respectively.

While these data reveal important temporal correlations between activities and behaviors, they do not reveal causality. The next analysis was designed to address this issue. The chronological stream of events for this student was examined and the conditional probabilities of student behavior computed for each sequence of specific activity. These probabilities are graphed for two students and two behaviors to illustrate the causal relationship between activity switches and student behaviors. This particular methodology is an alternating

Insert Figure 5 about here

treatments design (Greenwood, 1985; Kazdin, 1982). This design provides a causal analysis to the extent that within-day switches to alternate treatments, in this case activities, are temporally correlated with reliable changes in student's behavior. In this case, the design reveals the effects of a naturalistic experiment in which the teacher manipulated changes in activities during the day. The graphs display and compare differences in magnitude and trend in student behaviors during repeated switches to the same activities that day. In this case, student 1 (upper panel) was systematically engaged when play was the prevailing activity and in contrast was not engaged when transition was the prevailing activity. A replication of these effects is provided by the subject in the lower panel. This subject from the same class but on a different day demonstrated similar effects.

These data were used by the classroom teacher as the basis for restructuring the classroom to promote more active student engagement. The demonstration of both temporal and causal covariations between activities and student behavior provide a convincing demonstration for both researchers and classroom teachers alike that classroom factors actually influence student behavior. These analyses are highly superior

to the prior molar analysis results in this respect because they provide an approach to actually intervening and assessing improvements in classroom practices.

A reduction in class time spent in transition was chosen as the primary target for this restructuring because transition was correlated with such low levels of engagement and because this activity occupied almost 30 percent of the entire school day, more than any other activity in the class schedule. The ESCAPE code is currently being used to monitor functional and causal changes in the preschool ecology and student behaviors resulting from the classroom rescheduling. Molecular analyses such as these provide important direction in the development of interventions and in evaluating effects across a broad array of variables. In addition, these analyses can be used to contrast individual children's behavior within settings as a function of different variables, or they can be applied to contrast children's behavior across different settings. These scores paired with student outcome measures can provide a vivid picture of classroom processes that are most highly related to programmatic success.

Discussion

The central thesis of this chapter was that methodological improvements in process assessment within program evaluation research is an essential element to the subsequent improvement of preschool intervention effectiveness. This improvement is due

to the validation of classroom ecological, teacher behavior, and student behavior process variables in relationship to gains in student outcome or product measures. This approach, in comparison to the prior history of early intervention research, will enable outcome gains to be explained with a minimum of confounding by structural, functional, and causal variations in process variables.

The use of process-product methodology to evaluate early intervention programs is a natural extrapolation of the research conducted in elementary grades on teacher behavior and its effect on student achievement (Brophy & Good, 1986). The methodology emerged in response to the Coleman Report (Coleman et al., 1966) that claimed that teachers do not make a difference in school achievement. The findings in this report were based on classic pretest-posttest designs that employed singular measures of achievement and included no data on the actual teaching events within classrooms. The early process-product studies used classroom observational data to demonstrate that variations in teacher behavior were systematically related to student achievement (Good, Biddle, & Brophy, 1975).

Program evaluation in early intervention is presently in the same state in which research in elementary schools found itself with the impact of the Coleman Report. Evaluation methodology in the preschool area has typically been limited to classic input-output measures with limited uses of actual classroom observation

(Odom & Fewell, 1983). As a result, the quality of program evaluation has suffered.

As we begin to apply the process-product methodology to preschool evaluation, we can benefit from some of the criticisms that have been leveled at the aproach in its application to the elementary grades. First, many process-product studies have been criticized for relying too heavily on achievement as the criterion for effectiveness. Many critics observed that achievement was too narrow and insensitive a variable and that classroom processes should not be reduced to a singular dimension (Dunkin & Biddle, 1974; Erickson, 1986). In a similar fashion, program evaluation in early intervention has overly relied on achievement and IQ to measure effectiveness of programs (Garwood, 1982; Wang & Elliott, 1982). We propose to conduct our process-product research by going beyond these typical measures and including less traditional outcomes such as successful placement in less restrictive placements after "graduating" from special preschools, teacher and parent ratings of social competence, as well as percentages of yearly educational objectives achieved. These diverse measures should expand our conception of program quality and we may find certain complements of process variables to be predictors or correlates of some outcome variables but not others.

A second criticism of the process-product studies conducted at the elementary school level was directed at the singular focus

of process measurement on teacher behaviors (Berliner, 1979; Erickson, 1986). Shulman (1986) noted that critics:

> wished to transfer the attention of the research-on-teaching community from concern for teacher behavior alone to more balanced consideration of the coordinate and immediate pupil responses to teaching. In addition, they felt that variations in some pupil indicators would provide a more sensitive estimate of the effects of teaching than the more distal product of achievement test performance. (p. 14)

Out of these concerns grew a new focus of study "Academic Learning Time", a complex variable representing the amount of time a student spent engaged in a particular content area using materials of an appropriate level of difficulty. A similar construct, "behavior engagement", has recently been proposed by McWilliam, Trivette, and Dunst (1985) as a measure of the efficacy of early intervention. These researchers defined engagement as "the amount of time children spend interacting with the environment (with adults, children, or materials) in a manner that is developmentally appropriate" (p. 80). Thus far, these authors have validated this index by demonstrating that engagement differed as a function of program orientation and classroom activities within programs. We have obtained identical findings defining engagement as a composite of several appropriate student behaviors measured by ESCAPE (Carta, 1986).

Full-scale process-product studies of preschool intervention

remain a somewhat distant goal until adequate measures of classroom process are developed and evaluation studies are completed. The ESCAPE system is one example of a system that may lead to process-product evaluation studies. The ESCAPE system incorporates features of both structural description and functional analysis based upon the recording of temporally concurrent events (i.e., ecological, teacher behavior, and student behavior). As we demonstrated from pilot data using the system, both molar and molecular analyses of preschool process can be obtained from the system and applied to specific types of process questions. These questions range from the relative amounts of specific eco-behavioral variables, to differences in these variables across schools, children, and days (i.e, molar and structural questions), to temporal correlations and causal covariations between ecological variables, teacher behaviors, and student behavior.

Within the limits of the small student sample and few replications, our pilot study data provided a "rich" analysis of student's behavior. These data indicated that preschool students may receive limited opportunities to respond to preacademic materials due to an instructional emphasis on transition and play. This overall lack of instructional structure in the classroom may have resulted in students spending time in less salient interactions with classroom aides as opposed to the classroom teacher, and concurrently, in large amounts of passive

attention rather than active task engagement. We expect that future process-product research using the ESCAPE system will reveal both the generality of these rather limited preacademic demands within preschool programs and the student outcomes in terms of gains in intelligence, standardized and criterion-referenced achievement, and parent satisfaction that are produced.

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Table 1

Preschool Observation System for Measuring Eco-behavioral Interactions

Ecological Sub-categories	Number of Codes	What Codes Describe	Code Examples
Designated Activity	13	Subject of instruction	free play, pre-academics, language, fine motor
Activity Structure	5	Degree to which a teacher directs an activity	Teacher choice/high structure, child choice/low structure
Materials	13	Objects which the student engages or attends to	Food, art, materials, large motor equipment
Location	9	Physical placement of the observed student	On floor, at tables, on equipment, in chairs
Grouping	5	Size of group in same activity as observed student	Small group, large group, whole class

Composition	7	Mix of handicapped and nonhandicapped students in instructional group	All handicapped, mixed, all nonhandicapped

Teacher Sub-categories	Number of Codes	What Code Describes	Code Examples
Teacher Definition	8	Primary adult interacting with observed student	Teacher, aide, student teacher, ancillary staff
Teacher Behavior	10	Teacher behavior relative to observed student	Verbal instruction, physical assisting, approval, disapproval
Teacher Focus	5	Direction of teacher's behavior	Target child only, target child and entire group, other than target child

Student Sub-categories	Number of Codes	What Code Describes	Code Examples
Appropriate Behaviors	10	Specific active on-task responses	Fine motor, gross motor, academic work
Inappropriate Behaviors	6	Behaviors which compete with appropriate engaged behaviors	Acting-out, off-task, self-stimulation
Talk	5	Verbalizations	Talk to teacher, talk to peer

Table 2

Sample ESCAPE Record for Illustrating Coded Events within Intervals Compiled into Temporal Sequences for Analysis

Minute	Desig Activ	Activ Struc	Mater	Loca	group	Compo	Teach Defin	Teach Behav	Teach Focus	Appr Behav	Inap. Behav	Talk
1	ST	TL	SB	AT	SG	AH	A	NR	N	ATT	N	N
2	ST	TL	SB	AT	SG	AH	A	NR	N	ATT	N	N
3	ST	TL	SB	AT	SG	AH	A	NR	N	MA	N	N
4	ST	TL	SB	AT	SG	AH	A	NR	N	ATT	N	N
5	ST	TL	SB	AT	SG	AH	A	NR	N	ATT	N	N
6	TH	TH	SB	AT	SG	AH	A	NR	NR	ATT	N	N
7	TH	TH	FOD	AT	SG	AH	A	NR	N	TH	N	N
8	SH	TH	FOD	UL	SG	AH	A	DSP	OTH	MA	N	N
9	SH	TH	FOD	AT	SG	AH	A	DSC	TG	ATT	N	N
10	SH	TH	FOD	UL	SG	AH	A	NR	N	TH	N	N
11	SH	TL	FOD	AT	SG	AH	A	NR	N	MA	N	N
12	SH	TL	FOD	AT	SG	AH	A	NR	N	MA	N	N
14	SH	TL	FOD	AT	SG	AH	A	NR	N	ATT	N	N
15	SH	TL	FOD	AT	SG	AH	A	NR	N	SC	N	N
16	SH	TL	FOD	AT	SG	AH	A	NR	N	SC	N	N
17	SH	TL	FOD	AT	SG	AH	A	NR	N	SC	N	N
18	NR	TL	AV	AT	SG	AH	A	NR	N	ATT	N	N
19	NR	TL	AV	AT	SG	AH	A	DSP	OTH	ATT	N	N
20	NR	TH	AV	AT	SG	AH	A	NR	N	ATT	N	N
21	NR	TL	AV	AT	SG	AH	A	NR	N	ATT	N	N

Note: Table abbreviations are as follows:

Desig Activ (Designated Activity) : TN = Transition
ST = Story
SN = Snack
MR = Music/Recitation

Activ Struc (Activity Structure) : TL = Teacher Low
TH = Teacher High

Mater (Materials) : NO = None
OM = Other Material
SB = Story Book
FOO = Food & Food Preparation Materials
AV = Audio Visual

Loca (Location) : TO = Time Out
AT = At Table
UL = Undefined Location

Group (Groups) : SO = Solitary
SG = Small Group

Compo (Composition) : NO = None
AH = All Handicapped

Teach Defin (Teacher Definition) : A = Aide
T = Teacher

Teach Behav (Teacher Behavior) : DSC = Discussion
AP = Approval
NR = No Response
IN = Instruction
VP = Verbal Prompt
DSP = Disapproval
GS = Gesture

Teach Focus (Teacher Focus) : TG = Target
OTH = Other
N = None
TBO = Target & Others

Appr Behav (Appropriate Behavior) : CT = Can't Tell
N = None
ATT = Attention
MA = Manipulating
SC = Self-Care Behaviors

Inapp Behav (Inappropriate Behaviors): CT = Can't Tell
N = None
OTB = Off-Task Behaviors

Talk : CT = Can't Tell
N = None
UT = Undirected Talk

Table 3

School Comparison Summary by All ESCAPE Categories

	Preschools				
Category	1	2	3	4	Mean
ACTIVITY					
Play	21.92	17.22	17.23	10.66	20.30
Snack	20.91	10.07	14.69	19.83	16.21
Fine Motor	10.59	13.37	11.24	5.08	8.83
Transition	11.41	14.29	30.31	29.39	20.50
Pre-Academic	8.60	19.60	1.78	9.34	9.87
Gross Motor	2.69	.92	1.03	4.20	2.20
Class Business	6.42	5.68	5.56	4.34	5.42
Music	2.95	7.14	6.32	7.00	5.53
Clean-up	4.51	7.69	2.32	3.88	4.05
Story	2.77	1.10	6.16	1.37	2.89
Self-Care	1.40	.18	3.24	2.52	1.70
Language	.31	——	——	1.91	.82
Can't Tell	4.51	2.75	.11	.47	1.66
ACTIVITY STRUCTURE					
Teacher Low	47.30	27.11	59.32	64.39	48.24
Teacher High	33.92	29.49	23.23	26.69	27.22
Child Low	13.36	35.35	15.51	8.13	20.60
Child High	5.11	7.33	1.78	.59	3.69
Can't Tell	.31	.73	.16	.19	.26

MATERIALS					
None	19.29	24.36	42.90	35.71	30.27
Food	23.89	10.62	16.37	21.89	18.00
Art/Writing	8.33	9.71	5.51	4.44	5.94
Large Motor Equip.	8.72	10.07	7.08	3.53	7.26
Instructional Mat.	13.98	19.96	6.81	10.82	10.97
Other Media	9.15	8.79	9.18	11.77	10.88
Pretend Play	8.21	5.86	1.24	3.67	5.75
Audio Visual	2.60	5.49	3.40	3.31	3.28
Games	1.14	1.47	—	—	1.15
Bathroom Materials	2.60	.73	.54	1.67	1.47
Story Books	3.04	2.01	5.89	2.06	3.54
Can't Tell	.26	.92	.27	.19	.31
Electronic	—	—	.81	.91	.72
LOCATION					
At Table	44.15	20.88	42.73	66.33	43.70
Undefined	11.23	18.86	16.21	9.08	13.19
On Floor	18.71	39.38	19.88	7.91	22.04
Outside	4.93	4.68	3.08	3.75	5.10
Out of Room	3.81	2.01	7.07	3.68	3.77
On Equipment	5.14	8.79	3.94	1.49	5.19
In Chair	3.82	—	1.62	.71	2.03
In Line	.49	4.21	2.49	4.43	2.36
Time Out	—	1.28	2.97	2.62	1.76

GROUPING					
Small Group	69.00	40.84	33.43	57.04	52.68
One-on-One	20.40	4.58	12.43	3.59	9.25
Solitary	10.33	7.33	12.05	11.68	10.86
Can't Tell	.27	.18	.32	.15	.24
Large Group	——	47.07	41.76	27.67	35.97
COMPOSITION					
All Handicapped	68.72	.18	28.53	72.32	44.36
No One	30.68	11.36	24.42	15.14	20.08
Mostly Handicapped	.04	——	43.97	.15	12.57
All Non-Handicapped	.32	61.90	1.08	.34	20.69
Can't Tell	.27	.18	——	.26	.29
Mostly Non-Handi	——	26.37	.38	11.79	9.69
Equal	——	——	1.62	——	.84
TEACHER DEFINITION					
Teacher	56.27	30.04	14.97	21.97	30.96
Aide	31.04	14.65	72.93	64.93	46.50
Ancillary Staff	9.51	——	3.57	4.65	5.62
Student Teacher	1.39	44.51	——	——	18.66
Volunteer	.52	8.97	5.46	2.68	4.75
None	.96	1.65	1.51	2.55	2.17
Can't Tell	.32	.18	1.57	2.90	1.37
Substitute	——	——	——	.32	1.43

TEACHER BEHAVIOR					
No Response	48.55	56.59	54.07	56.00	52.86
Verbal Prompt	18.18	10.81	13.18	12.03	13.56
Discuss	15.73	12.45	3.73	5.36	9.42
Instructions	4.50	5.13	.92	4.49	4.62
Physical Assist	4.01	2.38	13.61	6.05	7.06
Disapproval	2.38	2.01	4.86	6.67	3.81
Read/Sing	1.53	4.95	5.24	3.80	3.69
Gesture	.73	.18	.81	1.45	.85
Can't Tell	.91	1.28	1.35	1.01	1.12
Approval	3.49	4.21	2.22	2.25	3.00
FOCUS OF TEACHER					
None	48.50	56.59	54.32	56.10	52.87
Target	21.09	9.89	13.88	7.22	12.37
Other	20.78	13.74	22.80	25.48	22.55
Target & Other	6.49	18.86	8.37	10.49	10.90
Can't Tell	.41	.92	.92	.69	.63

STUDENT APPROPRIATE BEHAVIOR					
Attend	43.70	44.32	49.97	46.85	46.28
Manipulate	23.12	19.41	15.13	16.93	19.18
Self-Care	8.64	3.11	7.56	10.33	7.43
Transition	8.31	10.81	17.61	11.41	11.42
Gross Motor	5.98	10.44	2.32	3.11	5.05
None	3.92	6.78	4.97	5.61	4.96
Pretend	1.84	1.19	——	.58	1.36
Academic Work	2.24	.18	.49	.94	1.96
Sing/Recite	.72	2.01	.16	1.78	1.27
Can't Tell	1.52	1.88	1.78	2.47	1.90
STUDENT INAPPROPRIATE BEHAVIOR					
None	90.91	83.51	68.88	80.89	84.83
Off-Task	3.81	7.33	7.35	6.73	5.20
Inappropriate Loca.	1.51	2.20	.86	1.06	2.49
Self-Stimulation	1.99	3.48	16.37	7.08	5.27
Can't Tell	——	1.65	1.51	2.05	1.53
TALK					
None	84.86	90.84	98.33	92.23	88.95
Talk to Teacher	9.16	2.01	.43	3.53	4.62
Undirected	3.26	2.75	.05	1.63	2.39
Talk to Peer	1.37	2.75	——	.95	2.66
Can't Tell	1.35	1.65	1.19	1.66	1.38

Note. All scores are expressed as percentage of intervals during which target children were observed in each code. Total intervals (minutes) recorded in each preschool ranged from 1614 in Preschool 2 to 5968 in Preschool 4.

Table 4

Child Comparison Summary by Selected ESCAPE Categories

Category	Larry	Hope	Rick
ACTIVITY			
Play	17.22	27.22	34.96
Snack	10.07	7.34	6.16
Fine Motor	13.37	9.46	6.88
Transition	14.29	12.74	13.77
Pre-Academics	19.60	24.71	14.49
Gross Motor	.92	.19	———
Class Business	5.68	4.83	3.08
Music	7.14	6.37	7.97
Clean-up	7.69	4.83	3.80
Story	1.10	1.54	7.97
Self-Care	.18	.19	.18
Language Program	———	———	———
Can't Tell	2.75	.58	.72

TEACHER BEHAVIOR			
No Response	56.59	57.72	45.65
Verbal Prompt	10.81	9.07	6.88
Discuss	12.45	11.58	13.22
Instruction	5.13	7.92	11.78
Physical Assistance	2.38	1.35	7.61
Disapproval	2.01	.97	1.27
Head/Sing	4.95	5.79	7.43
Gesturing	.18	.19	———
Can't Tell	1.28	1.74	1.45
STUDENT APPROPRIATE BEHAVIOR			
Attend	44.32	48.07	56.19
Manipulate	19.41	18.92	20.11
Self-Care	3.11	2.70	1.27
Transition	10.81	8.30	11.23
Gross Motor	10.44	7.53	2.54
Nono	6.78	2.12	2.72
Pretend	1.10	6.76	.91
Academic Work	.18	1.35	1.45
Sing/Recite	2.01	3.09	2.17
Can't Tell	1.83	1.16	1.45

Note. All scores are expressed as percentage of intervals during which target children were observed in each code. Total intervals (minutes) recorded for each child ranged from 518 for Larry to 550 for Rick.

Table 5

Appropriate Student Engagement as a Function of ESCAPE Tasks

	Appropriate Student Engaged Responses							
Activities	Manip-ulate	Self-Care	Gross Motor	Pretend	Academic Work	Sing/ Recite	Engagement Composite	Attend
Transition	8.2	2.8	1.6	.2	.4	.4	13.6	53.2
Play	33.8	1.3	17.7	5.1	—	—	57.9	24.1
Snack	9.0	38.5	.3	—	—	—	47.8	39.3
Fine Motor	54.3	—	—	—	—	—	54.3	37.1
Pre-Academic	11.1	—	.5	—	8.7	—	20.3	68.1
Gross Motor	6.4	—	8.5	—	—	—	14.5	68.1
Class Business	14.8	—	—	—	—	1.6	16.4	73.8
Music	9.3	—	4.1	4.1	—	20.8	38.3	48.6
Clean-up	17.4	4.4	2.9	—	—	—	24.7	42.0
Story	11.8	—	—	—	—	—	11.8	88.2
Self-Care	14.0	51.2	—	—	—	—	65.2	19.1
Language	18.2	9.1	—	—	9.1	—	36.4	55.6
All Activities/ All Day (Mean)	13.9	10.2	3.7	1.1	1.2	2.2	32.3	47.6

Note. All scores represent the conditional probability of a response - p (RilAi) defined as the joint occurrence of a response (Ri) and a specific activity (Ai) divided by the total frequency of the activity (Ai), or (RilAi)/Ai. For purpose of th investigation, conditional response probabilities were computed for seven specific student responses (i.e., manipulating, self-care, gross motor, pretending, academic work, sing/reciting, and attending) and for the engaged response composite containing the first six of these responses. Scores are based on 1768 intervals (minutes) of data.

Figure Captions

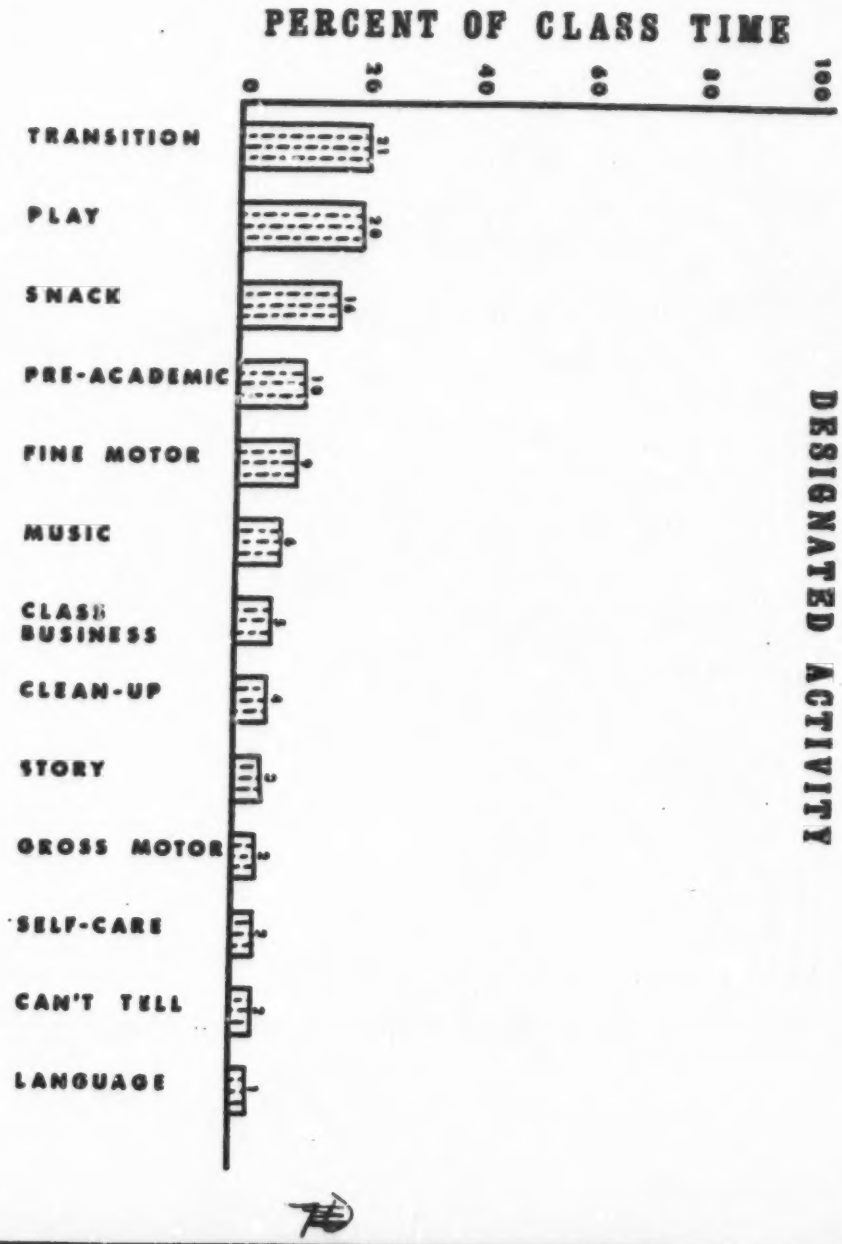
Figure 1. Percentage of time designated activities were observed to occur using the ESCAPE code.

Figure 2. Percentage of time types of materials were used by students.

Figure 3. Percentage of time apropriate student behaviors were observed to occur using the ESCAPE code.

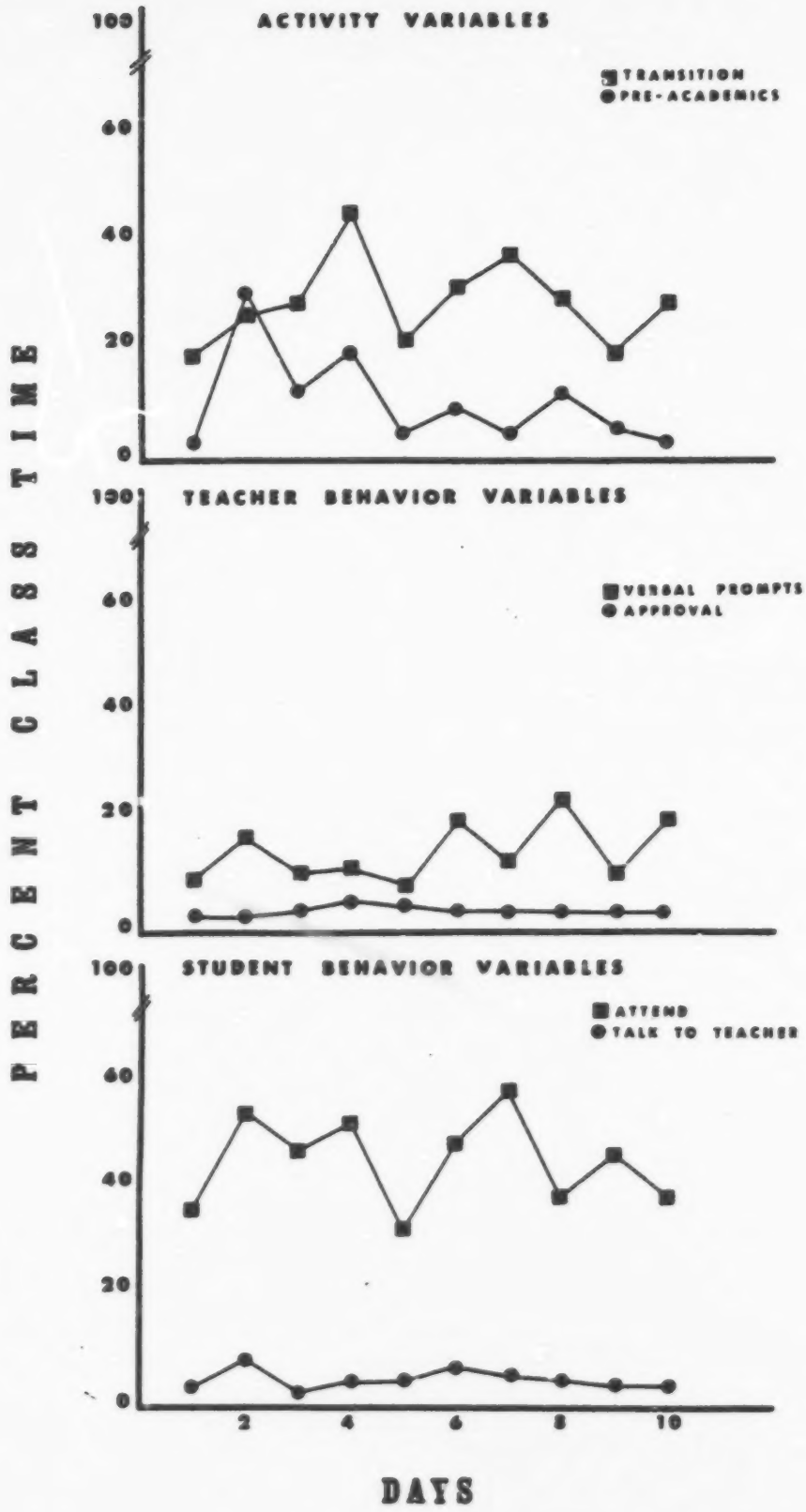
Figure 4. The range in code variablity across days illustrated with activities (upper panel), teacher behaviors (middle panel), and student appropriate behaviors (lower panel).

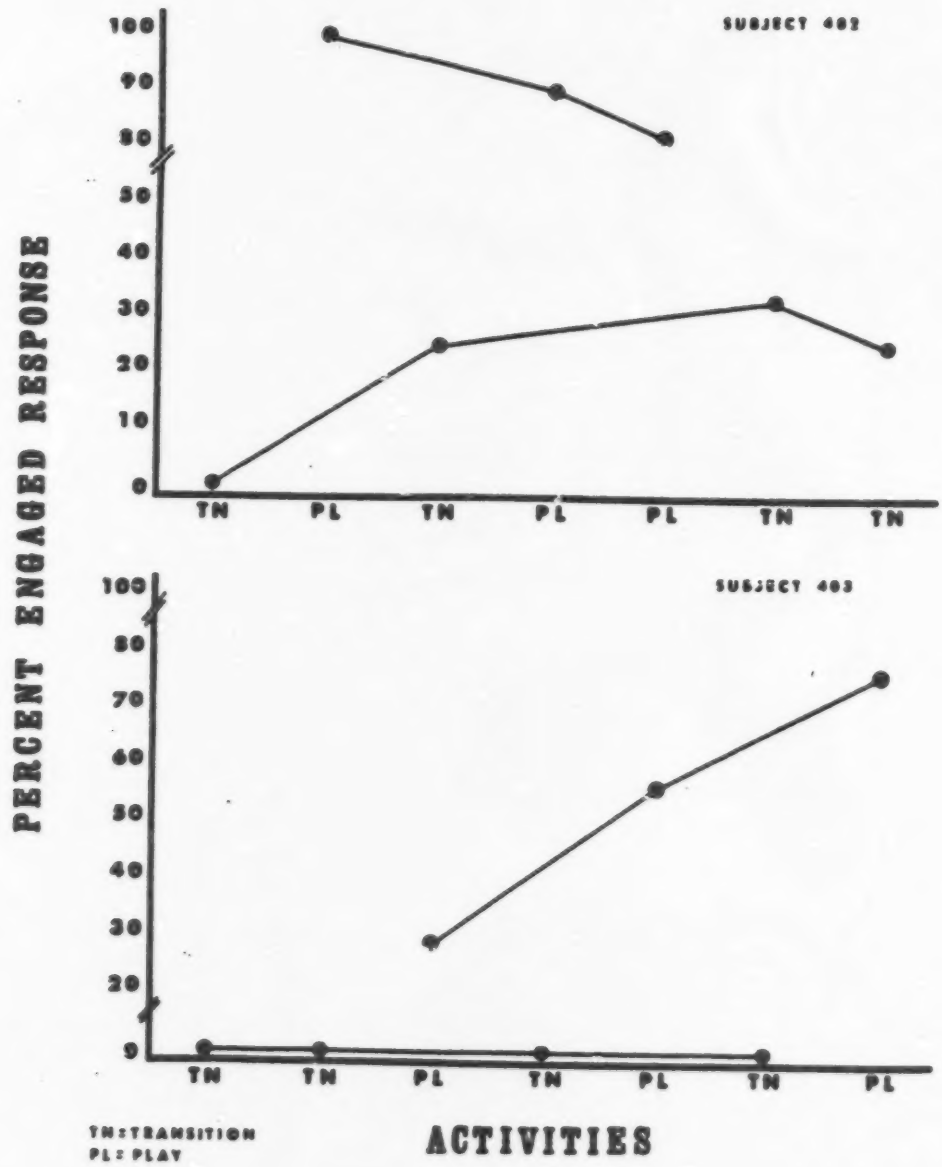
Figure 5. An alternating treatments design analysis of two students' engagement as a function of the natural, chronological sequence of activity.


PERCENT OF CLASS TIME
0
20
40
60
80
100
TRANSITION
PLAY
SNACK
PRE-ACADEMIC
FINE MOTOR
MUSIC
CLASS BUSINESS
CLEAN-UP
STORY
GROSS MOTOR
SELF-CARE
CAN'T TELL
LANGUAGE
DESIGNATED ACTIVITY

MATERIALS
PERCENT OF CLASS TIME
100
80
60
40
20
0
NONE
FOOD
INSTRUCTIONAL MATERIAL
OTHER MEDIA
LARGE MOTOR EQUIPMENT
ART-WRITING EQUIPMENT
PRETEND PLAY MATERIALS
STORY BOOKS
AUDIO-VISUAL MATERIAL
BATHROOM MATERIAL
GAMES
ELECTRONIC TEACHING TOYS
CAN'T TELL

PERCENT OF CLASS TIME
0
20
40
60
80
100
ATTEND
MANIPULATE
TRANSITION
SELF-CARE
GROSS MOTOR
NONE
ACADEMIC WORK
CAN'T TELL
PRETEND
SING/RECITE
APPROPRIATE BEHAVIORS


ACTIVITY VARIABLES
TRANSITION
PRE-ACADEMICS
TEACHER BEHAVIOR VARIABLES
VERBAL PROMPTS
APPROVAL
STUDENT BEHAVIOR VARIABLES
ATTEND
TALK TO TEACHER
PERCENT CLASS TIME
100
60
40
20
0
2
4
6
8
10
DAYS


SUBJECT 402
100
90
80
50
40
30
20
10
0
TN
PL
TN
PL
PL
TN
TN
SUBJECT 403
100
80
70
60
50
40
30
20
0
TN
TN
PL
TN
PL
TN
PL
PERCENT ENGAGED RESPONSE
TN: TRANSITION
PL: PLAY
ACTIVITIES